The wireless communication systems utilize electromagnetic wave propagation in a surrounding space. The lack of transmission medium in terms of wires or optical fibers gives much larger possibilities in comparison to the wire transmissions. The wireless systems operating at microwave frequencies (above 300 MHz) are used in local radio networks, mobile phone communications or global positioning systems. However, due to the extensive utilization of radio wave techniques for data transmission systems, e.g. IEEE 802.11 standard commonly known as WiFi, a problem of radio wave interferences appears, the intensity of which increases in parallel with the expansion of wireless data transmission techniques. One of the possible solutions for enhancement of electronic circuits' immunity (especially integrated circuits' immunity) to the radio wave interferences, is the utilization of so called differential signal transmission. In such a technique the signal propagating between transmitter and receiver flows in a two-wire line in such a way that one of the wires is excited with the signal A and the other with the signal –A. In the receiver a differential reception is applied and as a result 2A signal is retrieved. The elimination of interferences in such a technique relies on the fact that the interferences in both wires will be identical and in turn in the reception point they will be eliminated as a result of subtraction. Such a technique is commonly used for years at low frequencies and nowadays finds applications also in microwave circuits. It is important, however, in the design of radio wave systems, in which the differential technique is to be used, to minimize the number of conversions from- and to differential technique. The goal of the project is to carry out the research on the design of specialized microwave circuits allowing for splitting, combining and filtration on signals with the use of differential technique. Such a novel approach has not been until now used in the design of monolithic microwave circuits. Within the project the analysis of multi-conductor transmission lines will be performed, in which based on the appropriate reduction of per-unit-length capacitance and inductance matrices final parameters of interest will be derived, such as coupling coefficient and the characteristic impedance. In the next step the chosen coupled-line geometries will be numerically analyzed, and the obtained results will be used for optimization of coupled-line section's geometry in a way to obtain the assumed properties. Finally, the designed coupled-line sections will be analyzed electromagnetically and the frequency responses of the designed directional couplers or microwave filters will be obtained. The ultimate confirmation of the of the correctness of the proposed design methods will be the measurement results of the designed and manufactured microwave circuits realized in multi-layer PCB and monolithic technologies.